

Proposal of the *Caryanda aurata* species group (Orthoptera: Acrididae) with descriptions of two new species from China

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Abstract: The male genitalia of *Caryanda aurata* Mao, Ren & Ou, 2007 is redescribed. Two new species, *C. nigrotibia* sp. nov. and *C. zhenyuanensis* sp. nov. are described and illustrated. The concept of the *Caryanda aurata* species group is proposed to include these three species mentioned above, as well as *C. colourful* Mao, Ren & Ou, 2011. The key to known species of *C. aurata* species group is provided.

Key words: Caelifera; Caryandinae; taxonomy; key

金黄卵翅蝗种团的提议暨二新种记述（直翅目：蝗科）

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摘要: 描述了金黄卵翅蝗 *Caryanda aurata* Mao, Ren & Ou, 2007 的雄性外生殖器结构, 并记述 2 新种: 黑胫卵翅蝗 *C. nigrotibia* sp. nov. 及镇沅卵翅蝗 *C. zhenyuanensis* sp. nov.; 提出金黄卵翅蝗种团的建议, 以包含上述 3 种及彩色卵翅蝗 *C. colourful* Mao, Ren & Ou, 2011; 并给出该种团已知种的分种检索表。

关键词: 蝗亚目; 卵翅蝗亚科; 分类; 检索表

Introduction

The genus *Caryanda* Stål, 1878 was established with *Acridium spurium* Stål, 1860 as the type species. 85 species in this genus have been reported in the world so far, of which 69 species have been recorded in China and 25 species of them found in Yunnan Province (Eades *et al.* 2016; Li & Xia 2006; Mao & Li 2011; Mao *et al.* 2015a, b, 2016). To clarify the phylogenetic position among them, Mao & Li (2011) and Mao *et al.* (2015a, b, 2016) attempted to propose the concept of species groups of *C. amplexicerca*, *C. dentata*, *C. viridis* and *C. nigrospina*, in which the monophyly of *C. dentata* species group and *C. viridis* species group was supported by the phylogenetic relationship based on the COI gene sequences (Hu *et al.* 2016).

In this article, we recognize that the known species, *C. colourful* Mao, Ren & Ou, 2011, and two new species collected from Yunnan, named as *C. nigrotibia* sp. nov. and *C. zhenyuanensis* sp. nov. respectively. The two new species are extremely similar to *C. aurata* Mao, Ren & Ou, 2007 in general features, especially in the laterally beak-shaped apex of the

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apical penis valves. Therefore, we propose here a concept of a *Caryanda aurata* species group to include these four species within the genus *Caryanda*.

All materials used in this paper are pinned and deposited in the Biological Science Museum, Dali University (BMDU), Yunnan Province, China. In this work, Vickery's classification system (1997) is adopted and terminology is based on the work of Dirsh (1975) and Ingrisch (1989). The pinned specimens together with a ruler were photographed by digital camera (Canon EOS 60D). The line drawings were made using a stereomicroscope (Olympus SZX7) equipped with drawing apparatus and a micrometer. The line drawings and color figures are post corrected using Adobe Photoshop® CS2 software.

Taxonomy

Caryanda aurata species group

Diagnosis. *Caryanda aurata* species group shares the following diagnostic characters: male supra-anal plate nearly triangular or scutiform; male cerci conical; apical penis valves of phallic complex lathy, upcurved and with a beak-shaped apex in lateral view; ventral basivalvular sclerite with inner margins always contiguous with each other in females; hind femora partly red or orange in both genders.

This species group is endemic to Yunnan with four known species so far.

Key to the species of the *Caryanda aurata* species group

1. Body sized larger, body length 19.0–23.3 mm in male or 22.7–27.9 mm in female; dorsum of body colored blue in male or green in female, about basal half of hind femora yellowish and the apical half red in both genders..... 2
- Body sized smaller, body length 17.0–17.9 mm in male or 20.3–21.0 mm in female; dorsum of body colored green in both genders, hind femora mainly red or green in male..... 3
2. Below postocular bands, pronotum lateral lobes entirely colored yellow, but blackish inferior margins, hind femora with yellowish basal half and reddish apical half, most of hind tibiae blue (Figs. 1, 2); pronotum with dorsum densely foveolate; male supra-anal plate nearly triangular; posterior margin of female subgenital plate roundly projected at the middle..... *C. aurata* Mao, Ren & Ou
- Lateral lobes of pronotum black with two yellow maculae at the median area, hind femora with basal 2/5 yellow and apical 3/5 red, hind tibiae black in male or mainly blue in female (Figs. 3, 4); pronotum with dorsum sparsely foveolate; male supra-anal plate nearly scutiform; posterior margin of female subgenital plate concave in middle with two obtuse dentes (Fig. 21)..... *C. nigrotibia* sp. nov.
3. Dorsum of body green in both genders, hind femora with basal 1/5 yellowish green and apical 4/5 red in male, knees black in both genders (Figs. 5, 6); pronotum with surface smooth; female subgenital plate with posterior margin undulated, medially concaved with two blunt teeth (Fig. 29)..... *C. colourfula* Mao, Ren & Ou
- Dorsum of body green in male or brown green in female, hind femora with basal 3/5 yellowish green and apical 2/5 orange, knees black in male or brown red in female (Figs. 7, 8); pronotum with surface rough; female subgenital plate with posterior margin roundly projected at the middle (Fig. 37)..... *C. zhenyuanensis* sp. nov.

1. *Caryanda aurata* Mao, Ren & Ou, 2007 (Figs. 1, 2, 9–13)

Caryanda aurata Mao, Ren & Ou, 2007: 57.

Redescription of male genitalia. Epiphallus (Figs. 9–11): lophi nearly parallelogrammic in posterior view, distal-inner corner nearly rectangular, pointing dorsad; ancorae triangular, apex ventrad rolled; anterior projections possessing upper margins fairly straight; bridge divided at the middle. Phallic complex (Figs. 12, 13): cingular valves and apical penis valves lathy, upcurved, distally tapering, and with a beak-shaped apex in lateral view, cingular valves fused apically.

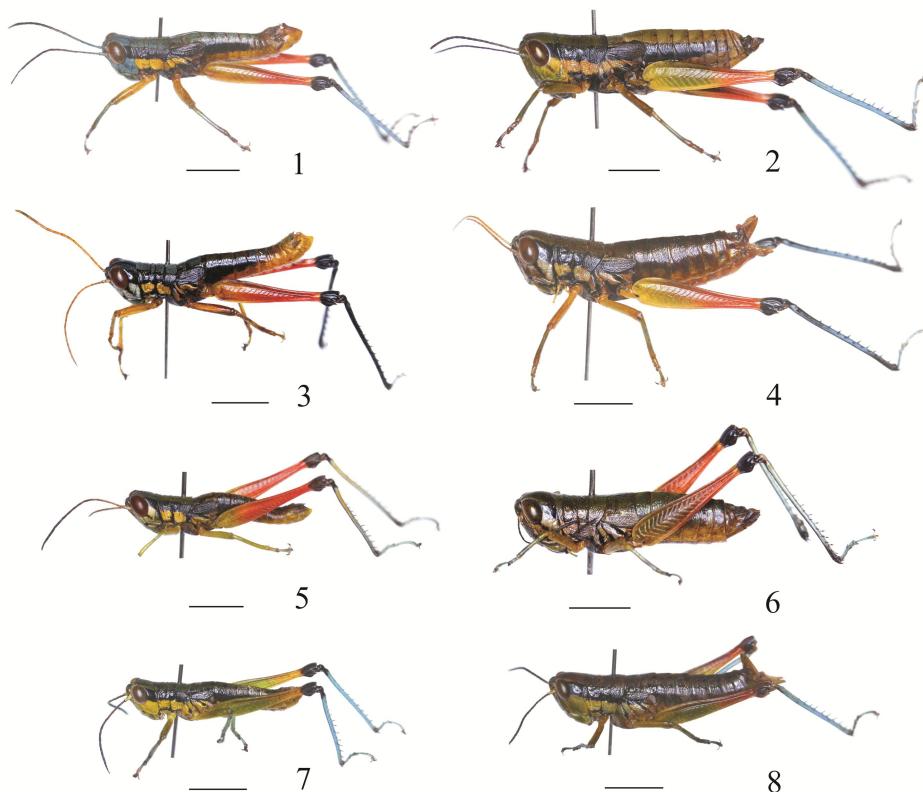
Specimens examined. ♂, Holotype (deposited in BMDU), **China**, Yunnan, Maguan, 22°49'N, 103°58'E, alt. 1700 m, 20-VII-2006, leg. Zizhong YANG. Other specimens. 20♂ 5♀ (deposited in BMDU), data same as holotype but collected by Benyong MAO, Jishan XU, Yulong WANG, Haoyu LIU, Yuxia YANG and Qiqi WU.

Distribution. China (Yunnan).

Remarks. The epiphallus and phallic complex of *C. aurata* were wrongly described as that of another species (*C. maguanensis* Mao, Ren & Ou, 2011) by the original authors. Here we revise it and redescribe the male genitalia.

2. *Caryanda nigrotibia* sp. nov. (Figs. 3, 4, 14–21)

Body sized small in both genders, but stouter in female.

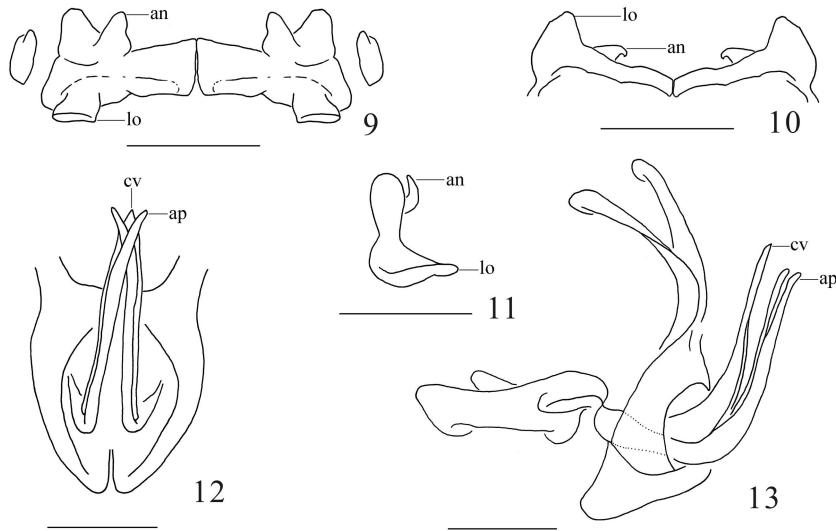


Figures 1–8. Habitus of adults, lateral view. 1, 3, 5, 7. ♂; 2, 4, 6, 8. ♀. 1, 2. *Caryanda aurata* Mao, Ren & Ou, 2007; 3, 4. *C. nigrotibia* sp. nov.; 5, 6. *C. colourful* Mao, Ren & Ou, 2011; 7, 8. *C. zhenyuanensis* sp. nov. Scale bars = 5 mm.

Head. Head shorter than pronotum; fastigium roundly pentagonal in dorsal view, feebly

depressed in the middle. Face oblique in lateral view, surface thinly punctured; frontal ridge with longitudinal sulcus deep in male or shallow in female; lateral margins nearly parallel, but somewhat extended around median ocellus and slightly constricted near transverse facial sulcus in male. Lateral facial keels thick. Antennae filiform, retrad reaching the base of hind femur (δ) or coxa (φ) of hind leg, median segments 3.1–3.3 (δ) or 2.8–3.2 (φ) times longer than wide. Eyes oval, longitudinal diameter 1.4–1.5 (δ) or 1.4–1.5 (φ) times as long as horizontal diameter, and 2.5–2.6 (δ) or 2.0–2.1 (φ) times as long as subocular furrow.

Thorax. Pronotum nearly cylindrical, surface sparsely foveolate, anterior margins somewhat arcuate, posterior margins nearly arcuate (δ) or straight (φ), faintly concave medially in both genders; median carina indistinct, lateral carinae absent; three transverse sulci distinct; prozona 1.9–2.3 (δ) or 2.3 (φ) times as long as metazona; lateral lobe with posteroventral corner obtuse. Prosternal spine long conical, straight, apex weakly acute (δ) or subobtuse (φ). Mesosternal interspace 2.1–2.3 (δ) or 1.1–1.2 (φ) times longer than minimum width; metasternal lobes with each other contiguous in male or separated in female. Tegmina narrow scale-like, 2.6–2.7 (δ) or 2.6–2.8 (φ) times longer than maximum width, apex reaching (φ) or surpassing (δ) posterior margin of 1st abdominal tergite. Hind femora with upper carina smooth and terminating in an acute angle; lower genicular lobes spined. Hind tibiae with apical half nearly cylindrical, with 8 external and 10–11 internal spines on dorsal side; external apical spine small. Tympanum opened distinctly, oval.

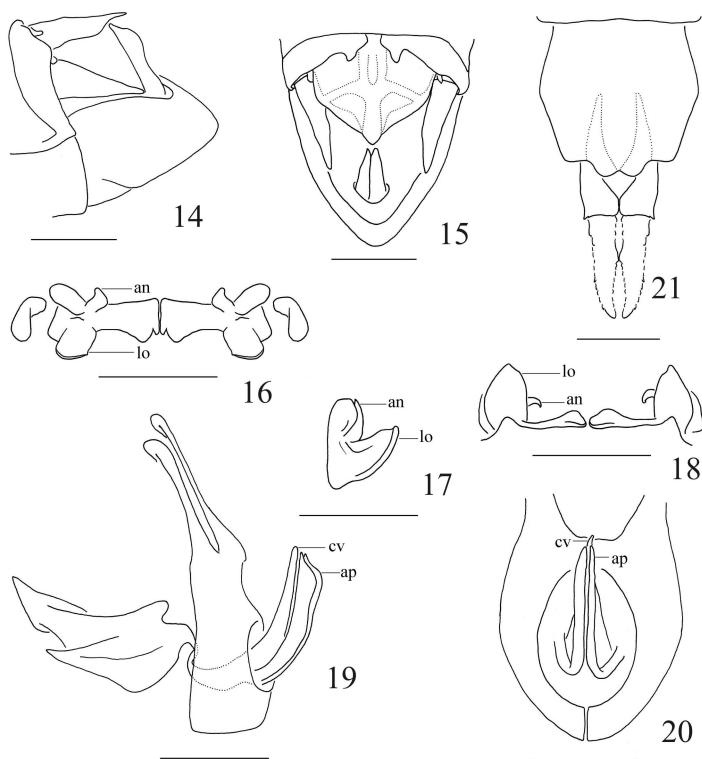


Figures 9–13. *Caryanda aurata* Mao, Ren & Ou, 2007. 9–11. Epiphallus, dorsal, posterior and lateral views; 12, 13. Phallic complex, apical and lateral views. Scale bars = 1 mm. an — ancora; ap — apical valves of penis; cv — valves of cingulum; lo — lophus.

Abdomen. Male genitalia (Figs. 14, 15). Tenth abdominal tergite broadly divided in the middle, with small furculae on posterior margin. Supra-anal plate broadly scutiform; width at base about 1.2 times larger than maximum length; basal half with a broad median longitudinal sulcus, lateral areas concave, median area with a transverse carina, posterior margin rounded,

triangularly angulated in the middle. Cerci long conical, terminal part sharply narrowing, apex obtusely sharp. Subgenital plate short conical, apex obtuse. Epiphallus (Figs. 16–18): lophi nearly oval, flame-like in posterior view, distal-inner corner nearly rectangular, pointing dorsad; ancorae fingerlike, with upper margins dorsad projecting, apex ventrad rolled; anterior projections with upper margins moderately projecting dorsad; bridge broad, divided in middle. Phallic complex (Figs. 19, 20): cingular valves and apical penis valves lathy, upcurved and with a beak-shaped apex in lateral view, cingular valves fused apically.

Female genitalia. Subgenital plate nearly oblong, posterior margin concave in the middle with two obtuse dentes (Fig. 21). Ventral basivalvular sclerite with inner margins always contiguous with each other. Upper and lower ovipositor valves with outer edges unevenly serrated.



Figures 14–21. *Caryanda nigrotibia* sp. nov. 14, 15. Male terminalia, lateral and dorsal views; 16–18. Epiphallus, dorsal, lateral and posterior views; 19, 20. Phallic complex, lateral and apical views; 21. Subgenital plate and ovipositor, ventral view. Scale bars = 1 mm. an — anchora; ap — apical valves of penis; cv — valves of cingulum; lo — lophus.

Coloration (Figs. 3, 4). Body blue (δ) or green (φ) in dorsal view. Frons and genae grey-blue (δ) or yellow (φ). Eyes brown. Antennae yellow except apical segments dark. Postocular bands black, continuing on dorsal area of lateral lobes of pronotum and abdominal tergites. Lateral lobe of pronotum with two yellow maculae on median area, inferior margins black. Prosternum and prosternal spine yellow. Mesothorax with episternum and epimeron

yellow. Metathorax with episternum and epimeron yellow. Tegmina black except anal area sometimes green. Fore and middle legs yellow. Hind femora with basal 2/5 yellow and apical 3/5 red; hind tibiae black (δ) or mainly blue (φ). Abdominal tergites darkish green; abdominal sternites yellow; abdominal terminalia yellow.

Measurements (mm). Body length: δ 19.0–20.0, φ 22.7–25.0. Pronotum length: δ 3.4–3.5, φ 4.7–5.0. Tegmen length: δ 3.0–3.2, φ 3.8–4.0. Hind femur length: δ 10.5–11.0, φ 12.7–14.1.

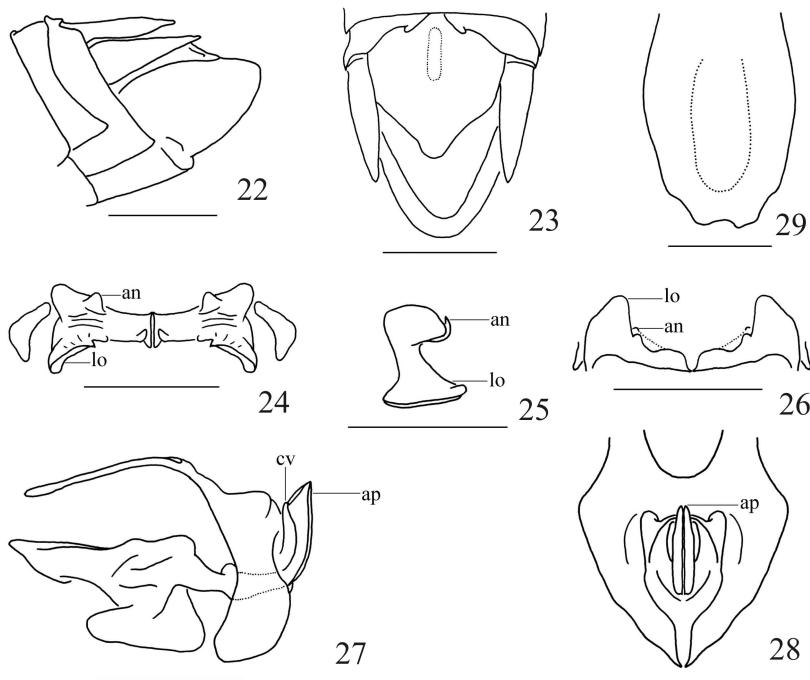
Holotype. δ , China, Yunnan, Jiangcheng, 22°36'N, 101°52'E, alt. 1300 m, 07-VIII-2012, leg. Benyong MAO. **Paratypes.** 6 δ 4 φ , data same as holotype; 1 δ , 12-VII-2009, leg. Jishan XU & Miao LI, other data same as holotype. Type specimens are deposited in the BMDU.

Distribution. China (Yunnan).

Etymology. The specific epithet *nigrotibia* means that tibiae of male is black.

Diagnosis. This new species is similar to *C. aurata* Mao, Ren & Ou, 2007, but differs from the latter by the following characters: lateral lobes of pronotum black with two yellow maculae on median area; hind femora with 2/5 basal portions yellowish and the apical 3/5 red; hind tibiae of male black; pronotum armed with dorsum sparsely foveolate; male supra-anal plate almost scutiform; posterior margin of female's subgenital plate concave medially with two obtuse denticles.

3. *Caryanda colourfula* Mao, Ren & Ou, 2011 (Figs. 5, 6, 22–29)



Figures 22–29. *Caryanda colourfula* Mao, Ren & Ou, 2011. 22, 23. Male terminalia, lateral and dorsal views; 24–26. Epiphallus, dorsal, lateral and posterior views; 27, 28. Phallic complex, lateral and apical views; 29. Female subgenital plate, ventral view. Scale bars = 1 mm. an — ancora; ap — apical valves of penis; cv — valves of cingulum; lo — lophus.

Caryanda colourfula Mao, Ren & Ou, 2011: 62.

Specimens examined. ♂ (Holotype) (deposited in BMDU), China, Yunnan, Jinping, 22°55'N, 103°13'E, alt. 1300–1400 m, 23-VII-2006, leg. Benyong MAO. Other specimens. 4♂1♀ (deposited in BMDU), 23–24-VII-2006, other data same as holotype; 3♂31♀ (deposited in BMDU), China, Yunnan, Yuanjiang, 23°06'N, 102°45'E, alt. 1829 m, 29-IX-2009, leg. Benyong MAO; 1♂ (deposited in BMDU), China, Yunnan, Yuanyang, 23°23'N, 102°07'E, alt. 1731 m, 01-X-2009, leg. Benyong MAO.

Distribution. China (Yunnan).

4. *Caryanda zhenyuanensis* sp. nov. (Figs. 7, 8, 30–37)

Description. The new species is similar to *C. nigrotibia* sp. nov. and *C. colourfula* in general characteristics. The differences between the new species and the others are presented as following.

Head. Antennae filiform, retrad reaching coxa of hind leg (♂) or posterior margin of pronotum (♀); median segments 2.1–2.4 (♂) or 1.8–1.9 (♀) times longer than wide. Eyes with longitudinal diameter 1.4–1.5 (♂) or 1.5–1.6 (♀) times as long as horizontal diameter, and 1.9–2.0 (♂) or 1.5–1.6 (♀) times as long as subocular furrow.

Thorax. Pronotum in both genders nearly cylindrical, surface rough, posterior margins shallowly excised at the middle; prozona 2.1–2.3 times as long as metazona. Mesosternal interspace 2.1–2.2 (♂) or 1.4–1.5 (♀) times longer than minimum width. Tegmina with length 3.1–3.2 (♂) or 2.9–3.0 (♀) times larger than maximum width.

Abdomen. Male genitalia (Figs. 30, 31). The tenth abdominal tergite broadly medially divided but contiguous at base, with small furculae on posterior margin. Supra-anal plate nearly scutiform; the width at base about 1.1 times larger than maximum length; basal half with broad median longitudinal sulcus, lateral areas concave, median area with a indistinct transverse carina, posterior margin angularly projecting, apex rounded. Cerci short conical, terminal portion sharply narrowing, apex obtusely sharp. Subgenital plate short conical, apex obtuse. Epiphallus (Figs. 32–34): lophi triangular in posterior view, distally tapering, pointing dorsad; ancorae triangular, apex blunt, ventrad rolled; anterior projections with upper margins nearly straight; bridge broad, divided at the middle. Phallic complex (Figs. 35, 36): cingular valves and apical penis valves lathy, up-curved and with an apex beak-shaped in lateral view, cingular valves apically fused and outer margins ectad dilated.

Female genitalia (Fig. 37). Subgenital plate nearly oblong, posterior margin roundly projecting at the middle. Ventral basivalvular sclerite with inner margins always contiguous with each other. Upper and lower ovipositor valves with outer edges obtusely serrated.

Coloration (Figs. 7, 8). Body green (♂) or brown green (♀) in dorsal view. Frons and genae yellow or greenish yellow. Eyes brown. Antennae with basal segments brown, others dark. Postocular bands black (♂) or brown black (♀), continuing on dorsal area of lateral lobes of pronotum and abdominal tergites. Lateral lobe of pronotum entirely yellow below postocular bands except inferior margins black. Prosternum and prosternal spine colored black (♂) or brownish yellow (♀). Mesothorax ornamented with yellowish episternum and epimeron. Tegmina black (♂) or brown (♀). Fore and middle legs green yellow. Hind femora with 3/5 basal parts yellowish green and the apical 2/5 orange, knees black (♂) or brown red (♀); hind tibiae blue. Abdominal tergites darkish green; abdominal sternites yellow; abdominal

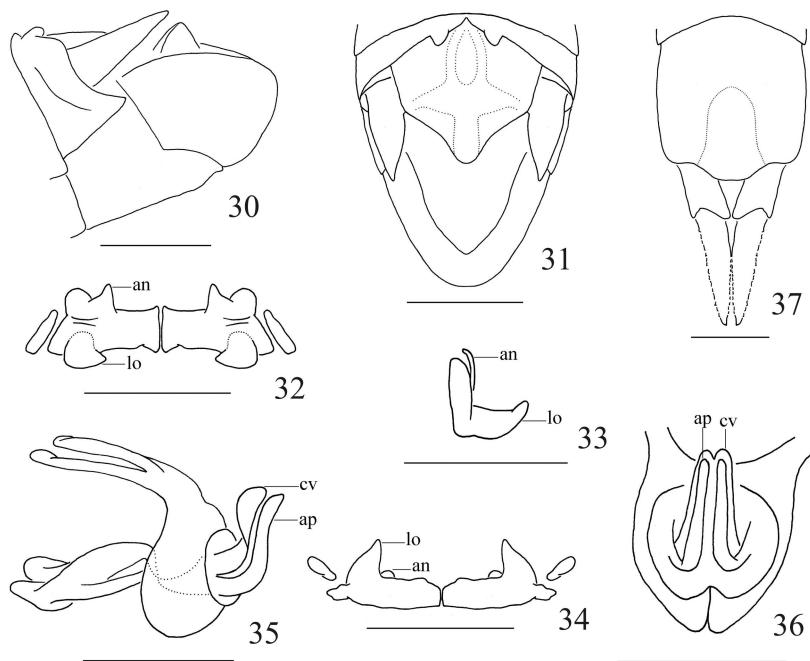
terminalia yellow.

Measurements (mm). Body length: ♂ 17.0–17.5, ♀ 20.3–21.0. Pronotum length: ♂ 3.0–3.2, ♀ 4.1–4.2. Tegmen length: ♂ 2.5–2.7, ♀ 2.3–2.9. Hind femur length: ♂ 9.5–9.6, ♀ 11.0–11.3.

Holotype. ♂, China, Yunnan, Zhenyuan, 24°17'N, 101°16'E, alt. 2170 m, 24-IX-2013, leg. Benyong MAO. **Paratypes.** 26♂15♀, data same as holotype; 27♂15♀, 2160 m, 19-VIII-2009, leg. Jishan XU & Jianxiong ZHANG, other data same as holotype. Type specimens are deposited in the BMDU.

Etymology. The specific epithet refers to the type locality, Zhenyuan County, Yunnan Province, China.

Diagnosis. This new species is similar to *C. colourful* Mao, Ren & Ou, 2011, but differs from the latter by the following characters: dorsum of body green in male or brownish green in female, hind femora with 3/5 basal portions yellowish green and the apical 2/5 orange, knees black in male or brownish red in female; pronotum with rough surface; female subgenital plate with posterior margin roundly projecting at the middle.



Figures 30–37. *Caryanda zhenyuanensis* sp. nov. 30, 31. Male terminalia, lateral and dorsal views; 32–34. Epiphallus, dorsal, lateral and posterior views; 35, 36. Phallic complex, lateral and apical views; 37. Subgenital plate and ovipositor, ventral view. Scale bars = 1 mm. an — ancora; ap — apical valves of penis; cv — valves of cingulum; lo — lophus.

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